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BOX: PATENT APPLICATION
Assistant Commissioner for Patents
Washington, D.C. 20231

Re: **Application of Seong-Wuk NA**
POWER MANAGEMENT METHOD FOR A PERSONAL DIGITAL ASSISTANT
Our Reference: Q49396

Dear Sir:

Attached hereto is the application identified above including the specification, claims, executed Declaration and Power of Attorney, two (2) sheets of drawings, executed Assignment and PTO Form 1595.

The Government filing fee is calculated as follows:

Total Claims	6 - 20 =	0 x \$22 =	\$ 000.00
Independent Claims	2 - 3 =	0 x \$82 =	\$ 000.00
Base Filing Fee	(\$790.00)		\$ 790.00
Multiple Dep. Claim Fee	(\$270.00)		\$ 000.00
TOTAL FILING FEE			\$ 790.00
Recordation of Assignment Fee			\$ 40.00
TOTAL U.S. GOVERNMENT FEE			\$ 830.00

Checks for the statutory filing fee of \$ 790.00 and Assignment recordation fee of \$ 40.00 are attached. You are also directed and authorized to charge or credit any difference or overpayment to Deposit Account No. 19-4880. The Commissioner is hereby authorized to charge any fees under 37 C.F.R. 1.16 and 1.17 and any petitions for extension of time under 37 C.F.R. 1.136 which may be required during the entire pendency of the application to Deposit Account No. 19-4880. A duplicate copy of this transmittal letter is attached.

Priority is claimed from:

Korean Patent Application

Filing Date

1997-42735

August 29, 1997

Respectfully submitted,
SUGHRUE, MION, ZINN, MACPEAK & SEAS
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**POWER MANAGEMENT METHOD
FOR A PERSONAL DIGITAL ASSISTANT**

BACKGROUND OF THE INVENTION

Field of the Invention

5 The present invention relates to a personal digital assistant, and in particular, to a power management method for a personal digital assistant which can be connected to an external communication terminal.

Description of the Related Art

10 A personal digital assistant (hereinafter referred to as PDA) is a multimedia device which allows one to access desired information in a desired form anytime and anywhere. The PDA has various utilities according to the user. For instance, the PDA has a personal information management (PIM) function for managing an address book, a telephone
15 directory, a personal scheduler and memorandum. The PDA also has an additional function for gathering and exchanging information by way of facsimile or personal computer (PC) communications. Recently, the PDA may also be
20 connected with an external communication terminal, such as a portable radio telephone. If necessary, the PDA and portable radio telephone may be unified into one body.

 When the external communication terminal and the PDA are unified, the PDA may become overloaded due to lack of
25 power supply voltage. Therefore, there has been a demand for a PDA capable of preventing the overload, even in the case where the external communication terminal is connected to the PDA.

SUMMARY OF THE INVENTION

30 It is therefore an object of the present invention to provide a power management method for preventing overload of a personal digital assistant which is connectable with an external communication terminal.

To achieve the above object, there is provided a power management method for a PDA (personal digital assistant) which can be connected to an external communication terminal. Upon detecting power-on of the external communication terminal, the PDA detects a battery voltage of the PDA and compares the battery voltage with a reference voltage which is slightly higher than an inoperable voltage threshold of the PDA. If the battery voltage is lower than the reference voltage, the PDA generates a low-voltage alarm message. Otherwise, if the battery voltage is higher than the reference voltage, the PDA makes a second voltage comparison between a) the difference between the battery voltage and the power required for the external communication terminal and b) the inoperable voltage threshold of the PDA. If the difference indicated in a) is larger than the voltage of b), the PDA supplies electric power to the external communication terminal.

BRIEF DESCRIPTION OF THE DRAWINGS

The above objects and other advantages of the present invention will become more apparent by describing the preferred embodiment of the present invention with reference to the attached drawings, in which:

FIG. 1 is a schematic block diagram of a personal digital assistant (PDA) which can be connected to an external communication terminal;

FIG. 2 is a flowchart for managing power of the PDA shown in FIG. 1 according to a preferred embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

A preferred embodiment of the present invention will be described in detail hereinbelow with reference to the accompanying drawings. To provide a comprehensive description of the present invention, the present invention will be illustratively described, confined to the specific

embodiment, but the invention is not limited thereto. Furthermore, it should be noted that the present invention can be implemented by anyone skilled in the art with the following general description. In the description, well-known functions or constructions are not described in detail to avoid obscuring the invention.

Referring to FIG. 1, a PDA 114 includes a central processing unit (CPU) 100 for controlling an overall operation of the PDA 114 according to a control program stored in a ROM (Read Only Memory) 104. The ROM 104 stores the control program of the CPU 100, data representative of a voltage drop according to the power consumption of an external communication terminal connected to the PDA 114, and various reference data (e.g., data indicative of an inoperable voltage V_i of the PDA). A RAM (Random Access Memory) 106 temporarily stores data generated in the process of executing the control program by the CPU 100. A keypad 108 includes a plurality of numeric and function keys for generating key data to the CPU according to a key operation supplied by the user. A display 110 displays the operational status of the PDA 114 under the control of the CPU 100. A connector 112 consists of a serial port to connect the PDA 114 to the external communication terminal, and interfaces various data and control signals with the external communication terminal under the control of the CPU 100. A battery level detector 102 detects a voltage level of a battery (not shown) of the PDA 114 under the control of the CPU 100.

FIG. 2 shows a flowchart for managing the power of the PDA 114. Generally, the CPU 100 detects a voltage difference between a battery voltage V_c and a voltage drop V_e according to the power consumption of the external communication terminal. The CPU cuts off the electric power to the external communication terminal if the voltage difference is lower than the inoperable voltage threshold V_i of the PDA 114. The control flow of FIG. 2 is programmed into the ROM 104 and executed by the CPU 100.

Now, referring to FIGS. 1 and 2, if the user turns on the external communication terminal connected to the PDA 114 at step 200, the CPU 100 of the PDA 114 proceeds to step 202 to detect the battery voltage V_c by virtue of the battery level detector 102. The CPU 100 checks, at step 204, whether the battery voltage V_c is higher than a first reference voltage V_o indicative of an alarm generation voltage. The alarm generation voltage V_o is a voltage slightly higher than a threshold voltage at which the PDA 114 cannot operate normally. The alarm generation voltage V_o can be properly set according to various operating conditions of the PDA 114. If the battery voltage V_c is lower than the alarm generation voltage V_o , the CPU 100 proceeds to step 218 to generate a low-voltage alarm message through the display 110 or a speaker (not shown) and to cut off electric power to the external terminal. Thereafter, the CPU 100 checks, at step 220, whether the battery voltage V_c is lower than the inoperable voltage V_i at which the PDA 114 cannot operate normally. If the battery voltage V_c of the PDA 114 is higher than the inoperable voltage V_i , the CPU 100 ends this process. However, if the battery voltage V_c of the PDA 114 is lower than the inoperable voltage V_i , the CPU 100 sets the PDA 114 to a sleep mode in step 222. In the sleep mode, every part of the PDA 114 is inactive other than particular functions of the CPU 100, such as a power-on/off function.

However, if the battery voltage V_c is higher than the alarm generation voltage V_o at step 204, the CPU 100 proceeds to step 206 to read, from the ROM 104, a voltage drop V_e corresponding to the power consumption, or voltage drop, of the external communication terminal. The ROM 104 previously stores data corresponding to the voltage drops V_e of respective external communication terminals to be connected to the PDA 114. The CPU 100 checks, at step 208, whether a voltage difference ($V_c - V_e$) between the battery voltage V_c and the voltage drop V_e is higher than the inoperable voltage threshold V_i of the PDA. If the voltage

difference is lower than the inoperable voltage V_i , the CPU 100 proceeds to step 212 to generate an alarm message informing the user that it is impossible to power on the external communication terminal connected to the PDA 114. Subsequently, the CPU 100 checks, at step 214, whether the external communication terminal is powered off. If it is not powered off, the CPU 100 returns to step 212 to repeat the steps 212 and 214 until the user powers off the external communication terminal. If the external communication terminal is powered off at the step 214, the CPU 100 cuts off the electric power to the external communication terminal at step 216. However, if the voltage difference ($V_c - V_e$) is higher than the inoperable voltage V_i , the CPU 100 proceeds to step 210 to supply electric power to the external communication terminal and then, returns to step 202. In this way, the PDA according to the present invention can prevent the overload of the battery.

Although an illustrative embodiment of the present invention has been described herein with reference to the accompanying drawings, it is to be understood that the invention is not limited to the precise embodiment so disclosed. Various other changes and modifications may be effected by one skilled in the art without departing from the scope or spirit of the invention.

WHAT IS CLAIMED IS:

1. A power management method for a personal digital assistant which can be connected with an external communication terminal, comprising the steps of:

upon detecting power-on of said external communication terminal, detecting a battery voltage of said personal digital assistant;

comparing said battery voltage with a reference voltage, said reference voltage being slightly higher than an inoperable voltage of said personal digital assistant;

generating a low-voltage alarm message when said battery voltage is lower than said reference voltage; and

supplying electric power to said external communication terminal, if said battery voltage is higher than said reference voltage.

2. The method as claimed in claim 1, further comprising the steps of:

comparing said battery voltage with an inoperable voltage threshold of said personal digital assistant; and

setting the personal digital assistant to a sleep mode when said battery voltage is lower than said inoperable voltage threshold of said personal digital assistant.

3. The method as claimed in claim 1, further comprising the steps of:

calculating a difference voltage between said battery voltage and a voltage drop according to a power consumption of said external communication terminal;

comparing said difference voltage with an inoperable voltage threshold at which said personal digital assistant cannot operate normally;

repeatedly generating an alarm message informing a user that the battery voltage is insufficient to normally activate said external communication terminal when said difference voltage is lower than said inoperable voltage

threshold, until said external communication terminal is turned off; and

15 providing electric power to said external communication terminal when said difference voltage is higher than said inoperable voltage threshold.

4. The method as claimed in claim 3, wherein said alarm message is generated through at least one of a display and a speaker.

5. A power management method for a personal digital assistant which can be connected with an external communication terminal, comprising the steps of:

5 upon detecting power-on of said external communication terminal, detecting a battery voltage of said personal digital assistant;

 comparing said battery voltage with a reference voltage, said reference voltage being slightly higher than an inoperable voltage of said personal digital assistant;

10 generating a low-voltage alarm message when said battery voltage is lower than said reference voltage; and
 comparing said battery voltage with an inoperable voltage threshold of said personal digital assistant when said battery voltage is lower than said reference voltage;
15 and

 setting the personal digital assistant to a sleep mode when said battery voltage is lower than said inoperable voltage threshold of said personal digital assistant;

20 supplying electric power to said external communication terminal when said battery voltage is higher than said reference voltage.

6. The method as claimed in claim 5, further comprising the steps of:

 calculating a difference voltage between said battery voltage and a voltage drop according to a power consumption

5 of said external communication terminal when said battery voltage is higher than said reference voltage;

comparing said difference voltage with said inoperable voltage threshold at which said personal digital assistant cannot operate normally;

10 repeatedly generating an alarm message informing a user that the battery voltage is insufficient to normally activate said external communication terminal when said difference voltage is lower than said inoperable voltage threshold, until said external communication terminal is
15 turned off; and

providing electric power to said external communication terminal when said difference voltage is higher than said inoperable voltage threshold.

ABSTRACT OF THE DISCLOSURE

A power management method for a PDA (personal digital assistant) which can be connected with an external communication terminal is described. Upon detecting power-on of the external communication terminal, the PDA detects a battery voltage of the PDA and compares the battery voltage with a reference voltage which is slightly higher than an inoperable voltage of the PDA. If the battery voltage is lower than the reference voltage, the PDA generates a low-voltage alarm message. Otherwise, if the battery voltage is higher than the reference voltage, the PDA supplies electric power to the external communication terminal.

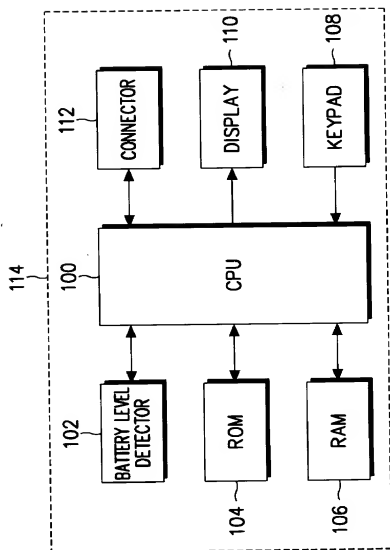
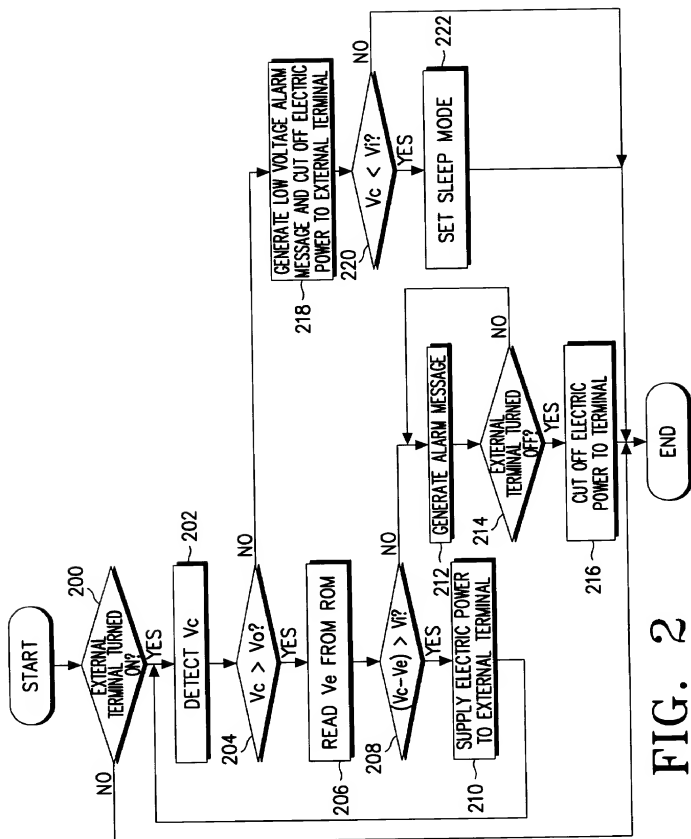


FIG. 1



Declaration and Power of Attorney for Patent Application

출원서류본상의 선서서와 위임장

Korean Language Declaration

한국어 선서서

하기한 발명자인 본인은 다음과 같이 선서합니다:

As a below named inventor, I hereby declare that:

본인의 주소, 우편주소 및 국적은 본인의 이름 밑에 기재된 바와 같습니다.

My residence, post office address and citizenship are as stated next to my name.

본인은 아래에 기재된 발명에 대한 최초의 단독발명자 (단 한사람의 이름이 아래에 기재되었을 경우) 또는 공동발명자 (복수의 발명자가 아래에 기재되었을 경우) 라고 믿습니다.

I believe I am the original, first and sole inventor (If only one name is listed below) or an original, first and joint inventor (If plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

POWER MANAGEMENT METHOD FOR A

PERSONAL DIGITAL ASSISTANT

아래 박스에 표시가 되어있지 않는 한
특허설명서는 여기에 첨부되어 있음:

the specification of which is attached hereto unless the following box is checked:

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로 출원되었으며
일 일 수정되었습니다.
(만약 적용가능하면)

☐ was filed on _____
as United States Application Number or
PCT International Application Number
and was amended on
(if Applicable).

본인은 상기 수정출원을 포함하여 특허설명서 내용을 검토하였으며 잘 파악하고 있음을 선서합니다.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

본인은 연방규정법전 37장 1.56조에 따라 특허자격에 있어 중요한 정보를 제공하고 있는 것이 본인의 의무임을 인정합니다.

I acknowledge the duty to disclose information which is material to patentability as defined in the Title 37, Code of Federal Regulations, Section 1.56.

Korean Language Declaration

한국어 선포서

본인은 미합중국법전 35장 119(a)-(d)편 또는 특허 또는 발명자 증서를 위한 그 어떤 외국출원의 365(b)편 또는 미국 이외에 최소한 한 국가를 지칭하는 PCT국제출원의 365(a)편하의 외국우선권을 주장합니다. 아래 박스에 표시함으로써 기재하고 확인합니다.

Prior Foreign Application(s)

이전의 외국 출원

1997-42735

(Number) (번호)

Korea

(Country) (국명)

29/08/1997

(Day/Month/Year Filed) (출원년월일)

Priority Not Claimed
우선권 주장안함

☐

(Number) (번호)

(Country) (국명)

(Day/Month/Year Filed) (출원년월일)

☐

(Number) (번호)

(Country) (국명)

(Day/Month/Year Filed) (출원년월일)

☐

본인은 미합중국법전 35장, 아래에 기재한 그 어떤 미국 가출원의 119(a)편하의 권한을 주장합니다.

(Application No.) (출원번호)

(Filing Date) (출원일)

I hereby claim the benefit under Title 35, United States Code, Section 119(a) of any United States provisional application(s) listed below.

(Application No.) (출원번호)

(Filing Date) (출원일)

본인은 미합중국법전 35장, 그 어떤 미국출원의 120(a) 편 또는 미국을 지칭하는 그 어떤 PCT국제출원의 365(c)편하의 권한을 주장합니다. 미합중국법전 35장 112편의 첫단락에 제시된 방법에 따라 이전의 미국 또는 PCT국제출원에 이례까지 기재된 본출원 내용은 밝혀지지 않습니다. 본인은 연방규정법전 37장 1.56편에 따라 이전출원의 출원일과 국내 또는 PCT국제출원의 출원일사이에 유효한 특허자격에 있어 중요한 정보자료를 밝히는 것이 본인의 의무임을 인정합니다.

(Application No.) (출원번호)

(Filing Date) (출원일)

I hereby claim the benefit under Title 35, United States Code, Section 120(a) of any United States application(s), or 365(c) of any PCT international application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT international application in the manner provided by the first paragraph of Title 35, United States Code Section 112. I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56 which becomes available between the filing date of the prior application and the national or PCT international filing date of application.

(Status: Patented, Pending, Abandoned) (현황: 특허완료, 심사중, 포기됨)

(Application No.) (출원번호)

(Filing Date) (출원일)

(Status: Patented, Pending, Abandoned) (현황: 특허완료, 심사중, 포기됨)

본인이 아는 바에 의하면 여기에 작성된 모든 기재사항들과 정보자료로 제출한 모든 기재사항들은 진실된 것임을 선언하며, 그리고 이러한 진술이 고의적인 허위진술이거나 이와 비슷한 경우에는 미합중국법전 18장 1001 편에 따라 벌금이나 징역형 또는 그 병과형으로 처벌되며, 허위진술은 본출원의 유효성이나 발명된 특허권을 위협하게 할 수도 있다는 점을 선언합니다.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Korean Language Declaration
한국어 선포서

위임장: 본인은 발명출원과 관련된 모든 사무를 처리하기 위하여 대리인을 지명합니다. 상기 각자는 대리인으로서 및 업무제휴가 되어있는 대리인을 지명할 전권을 갖습니다. (성명 및 등록번호 기재)

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith (list name and registration number)

I hereby appoint John H. Mion, Reg. No. 18,879; Donald E. Zinn, Reg. No. 19,046; Thomas J. Macpeak, Reg. No. 19,292; Robert J. Seas, Jr., Reg. No. 21,092; Darryl Mesic, Reg. No. 23,063; Robert V. Sloan, Reg. No. 22,775; Peter D. Oley, Reg. No. 24,513; J. Frank Osha, Reg. No. 24,625; Waddell A. Biggart, Reg. No. 24,861; Robert G. McMahon, Reg. No. 19,093; Louis Gubinsky, Reg. No. 24,835; Neil B. Siegel, Reg. No. 25,200; David J. Cushing, Reg. No. 28,703; John R. Igo, Reg. No. 26,516; Joseph J. Rich, Jr., Reg. No. 26,577; Sheldon I. Landsman, Reg. No. 25,430; Richard C. Turner, Reg. No. 29,710; Howard L. Bernstein, Reg. No. 25,665; Alan J. Kasper, Reg. No. 25,426; Kenneth J. Buchfiel, Reg. No. 31,333; Gordon KX, Reg. No. 30,764; Susan J. Mack, Reg. No. 30,951; Frank L. Bernstein, Reg. No. 31,484; Mark Boland, Reg. No. 32,197; William H. Mandir, Reg. No. 32,156; Scott M. Daniels, Reg. No. 32,562; Brian W. Hannon, Reg. No. 32,778; Abraham J. Rosner, Reg. No. 33,276; Bruce E. Kramer, Reg. No. 33,725; Paul F. Neils, Reg. No. 33,102; and Brett S. Sylvester, Reg. No. 32,765, my attorneys to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith, and request that all correspondence about the application be addressed to SUGHRUE, MION, ZINN, MACPEAK & SEAS, PLLC, 2100 Pennsylvania Avenue, N.W., Washington, D.C. 20037-3202.

서신을 위한 주소:

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Direct Telephone Calls to: (name and phone number)

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발명자의 서명 날짜	Inventor's signature Date July 18, 1998 Seong-Wuk NA
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두번째 합동 발명자 성명 (만약 있으면:)	Full name of second joint inventor, if any
두번째 발명자의 서명 날짜	Second inventor's signature Date
거주지	Residence
국적	Citizenship
우편주소	Post Office Address

(세번째와 그의 합동발명자의 위와 비슷한
기재사항과 서명을 제공하십시오.)

(Supply similar information and signature for third and
subsequent joint inventors.)